DEVICE FOR DETECTING THE COMBUSTION-CHAMBER PRESSURE IN AN INTERNAL COMBUSTION ENGINE

Background Information

A device for detecting a combustion-chamber pressure in a diesel engine, having a pressure sensor and a heating section of a glow plug, is described in German Patent No. DE 196 80 912. This heating section faces an internal space of a cylinder of the diesel engine and may be exposed to the combustion-chamber pressure. The heating section is secured within a housing of the glow plug by a fastening element. The pressure sensor is situated between this fastening element and the heating section.

In this system, the glow plug and the pressure sensor are supported by the same fastening element against the glow plug housing in such a way that the pressure sensor is affected by at least approximately the entire force acting upon the glow plug. In a disadvantageous manner, for certain sensor materials this results in the pressure sensor being also operated in its non-linear range, which results in a non-reproducible measuring signal and unreliable pressure detection in the combustion chamber of the engine.

Furthermore, the above-described arrangement of the pressure sensor being situated in the proximity of the internal space of the cylinder and being directly coupled to the glow plug during operation of the diesel engine is associated with a substantial heat load on the pressure sensor, thus jeopardizing its operational reliability. This may result in malfunction of the device for detecting the pressure in the combustion chamber of the engine and thus also in unreliable detection of the pressure in the combustion chamber of the engine, in particular when the signal output of the pressure sensor becomes unsteady due to fluctuations between high and low operating temperatures.

Summary Of The Invention

The device according to the present invention has the advantage over the related art that the above-mentioned shortcomings are avoided to a satisfactory degree.

For this purpose, the sensor is situated between the fastening element of the glow element of the glow plug and a second end of the glow plug. This offers the possibility of uncoupling the sensor from the total force acting upon the glow element and of operating it in its linear and low-hysteresis range. The separation between the attachment of the glow element and the attachment of the sensor in the glow plug allows the stressed area of the sensor to be delimited in a controlled manner in such a way that the optimum area of the sensor with respect to signal generation may be used for reliable and reproducible detection of the pressure in the combustion chamber of the engine.

Furthermore, the distance between the sensor and the glow element, as well as the thermal connection of the glow element via its attachment to the housing, causes a reduction in the heat load on the sensor, in such a way that its operational reliability is less affected, making the detection of the pressure in the combustion chamber of the engine more reliable.

According to an advantageous embodiment, there is an at least indirect frictional connection with pre-stress between the sensor and the glow element, which counteracts a hysteresis effect in detecting measured values.

It is furthermore advantageous that the sensor is separated from the glow element and the fastening element by at least one spacer. This design and stiffness may allow the maximum force acting upon the sensor to be adjusted.

It is also advantageous if the at least one spacer is designed as an intermediate sleeve, the sensor is designed as a piezoelectric ring, and the fastening element is designed as a sleeve. This allows heating and signal lines for the sheathed element glow plug and the sensor to be run through in a simplified manner.

Brief Description Of The Drawing

Figure 1 shows a simplified longitudinal section of the device for detecting the pressure in a combustion chamber of an engine.

Detailed Description

A device for detecting the pressure in a combustion chamber of an engine according to Figure 1 has a glow plug 11, which is installed in a cylinder head 14 of the engine depicted only schematically, in particular of a diesel engine, via an external thread 12 of a tubular metal housing 13.

A first end 16 of glow plug 11 has a glow element 17, which partially protrudes from housing 13 and a free end 18 of the glow plug protrudes into an internal space 19 of the engine, forming a combustion chamber. Glow element 17 is secured in glow plug 11 by a fastening element 22. This fastening element 22 is designed as a support tube which surrounds and fastens glow element 17 over its circumference in an end area 23 of its other end. Fastening element 22, in turn, is pressed into housing 13.

Alternatively, fastening element 22 may also be implemented as a graphite sleeve or in the form of a permanent bond, for example, a weld.

Sensor 26 is situated between fastening element 22 and thus between end area 23 of glow element 17 and second end 24 of glow plug 11. Sensor 26 is separated from glow element 17 by a spacer 27 in this embodiment. Alternatively, sensor 26 may also directly rest against glow element 17.

Sensor 26 is also supported by a fastener 29 for sensor 24 fixedly situated in housing 13 with spacer element 28 in between, thus establishing the position of sensor 26 in housing 13. Fastener 29 is designed, for example, as a sleeve caulked in housing 13 and may also alternatively rest directly against sensor 26.

Spacer 27 and spacer element 28 are designed as an intermediate sleeve 31, which is preferably made of ceramic or steel.

Contacting elements in the form of electric lines, used for supplying glow element 17 with power and for conducting the signals output by sensor 26, lead away from second end 24 of glow plug 11.

The above-described geometric arrangement of the important individual elements of the device for detecting the pressure in a combustion chamber of an engine is based on the following functions and effects.

During operation of the engine, combustion gases are generated in combustion chamber 19 and exert a pressure force on glow element 17 due to their limited expansion in combustion chamber 19. The axial components of the pressure force, directed in the longitudinal direction of glow plug 11 tend to displace glow element 17 toward second end 24 of glow plug 11. However, glow element 17 is largely prevented from being displaced by fastening element 22, which absorbs most of these pressure forces and transmits them to housing 13 and to cylinder head 14.

The pressure force on glow element 17 results, however, in elastic deformation of glow element 17, which is then absorbed by sensor 26, which is implemented, for example, as a pressure or distance sensor designed as a piezoelectric ring. The signal output by sensor 26 may be correlated with the pressure in combustion chamber 19 via characteristic curves. Ideally, the signal output by sensor 26 is a quantity proportional to the pressure in combustion chamber 19.

To detect the pressure in combustion chamber 19, sensor 26 may also be operated in a pre-stressed manner to reduce hysteresis effects, for example. For this purpose, after glow element 17 is fastened to housing 13 via fastening element 22, a predefined force is applied to sensor 26, to press it against glow element 17 even when the engine is stopped, alternatively even indirectly via intermediate spacer 27. This pre-stress is maintained by fastener 29 fixedly mounted in housing 13 or a spacer element 28 fastened to housing 13.

The maximum force on sensor 26 may then be adjusted via the stiffness of housing 13, fastening element 22, or fastener 29.

The separation between fastening element 22 for glow element 17 and fastener 29 for sensor 26 allows the optimum area of sensor 26 with respect to signal generation to be used for reliable and reproducible detection of the pressure in the combustion chamber of the engine.